(12) UK Patent Application (19) GB (11) 2 082 565 A

(21) Application No 8027106
(22) Date of filing 20 Aug 1980
(43) Application published 10 Mar 1982
(51) INT CL³ C03B 37/16
(52) Domestic classification C1M 400 401 TF
(56) Documents cited None
(58) Field of search C1M
(71) Applicants The Plessey Company Limited, Vicarage Lane, Ilford, Essex
(72) Inventor Stephen James Ashby
(74) Agents C. Goodman, The Plessey Company Limited, Vicarage Lane, Ilford, Essex

(54) **Vibrating cutter for optical fibres**

(57) Fibre 16 in groove 14 of anvil 12 is tensioned between clamps 18, 20 and scribed by cutter 30 to which minute high frequency vibrations are applied (e.g. by a piezo-electric transducer) until the fibre cleaves.

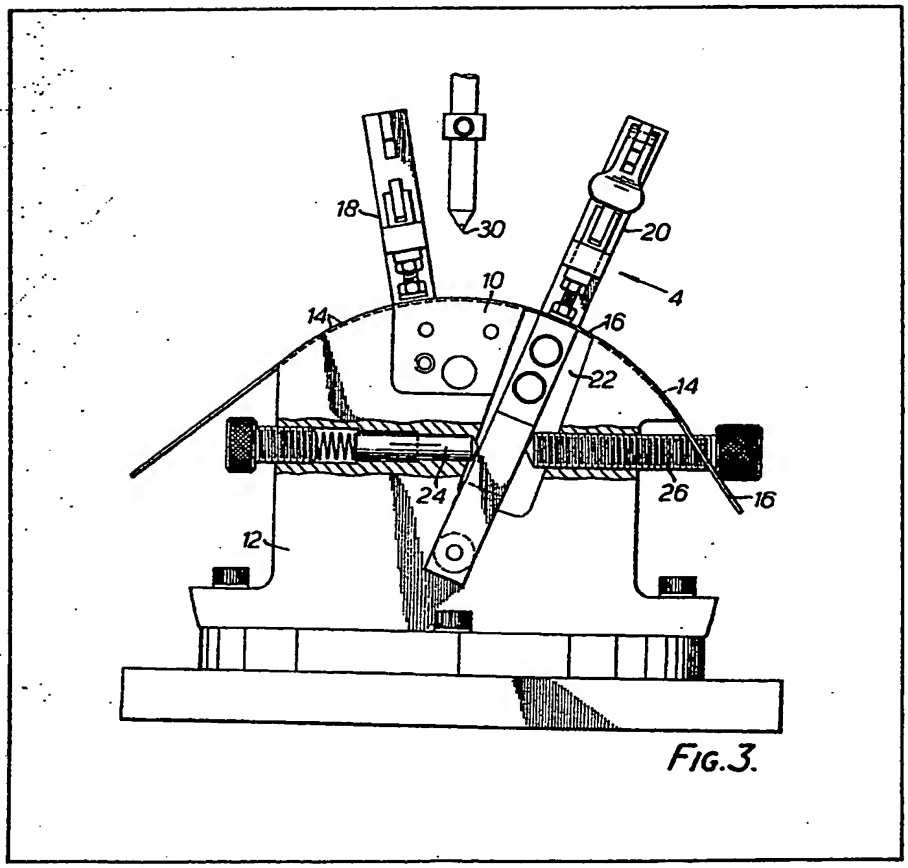

FIG.3.

GB 2 082 565 A

1/3

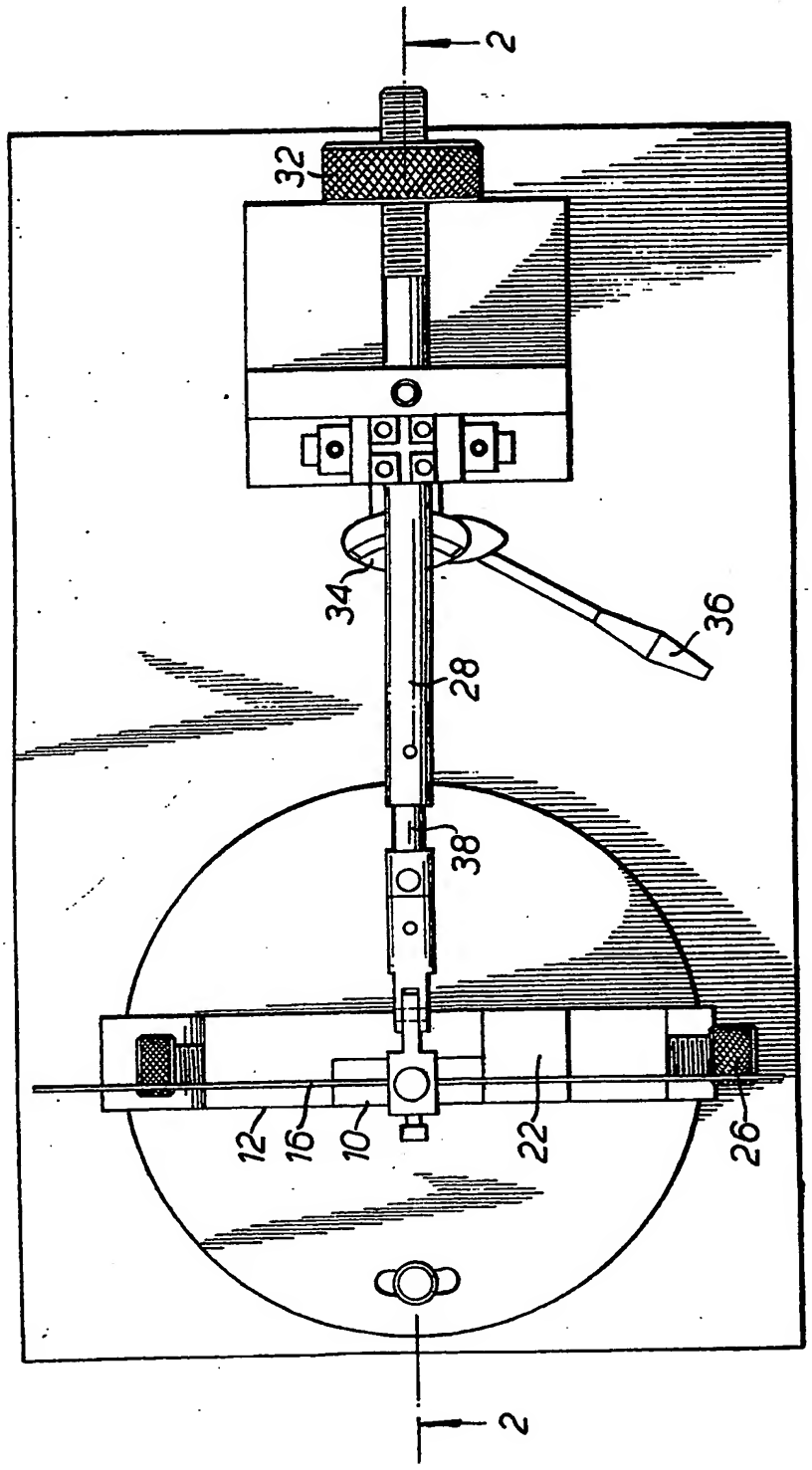

FIG. 1.

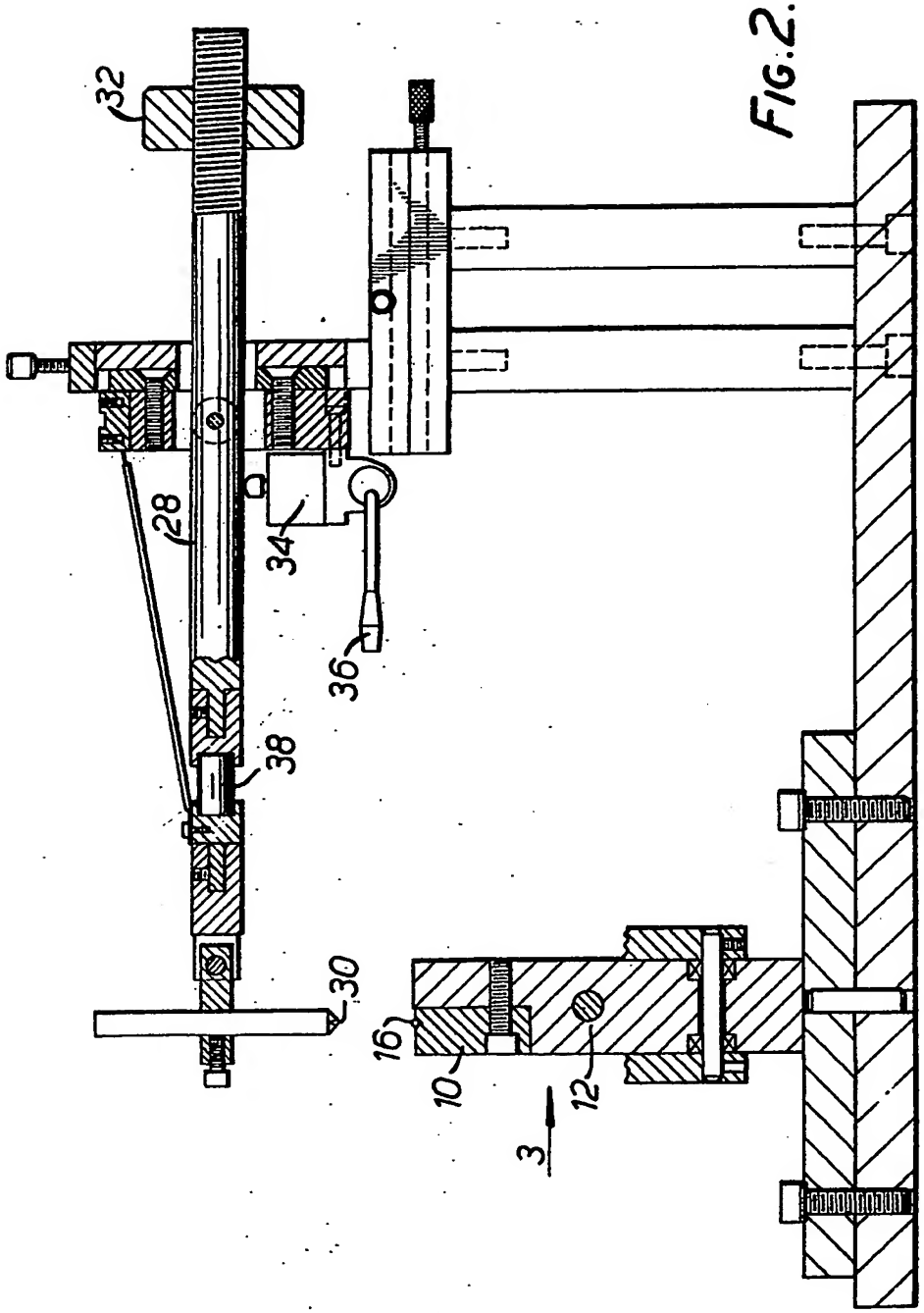

FIG.2.

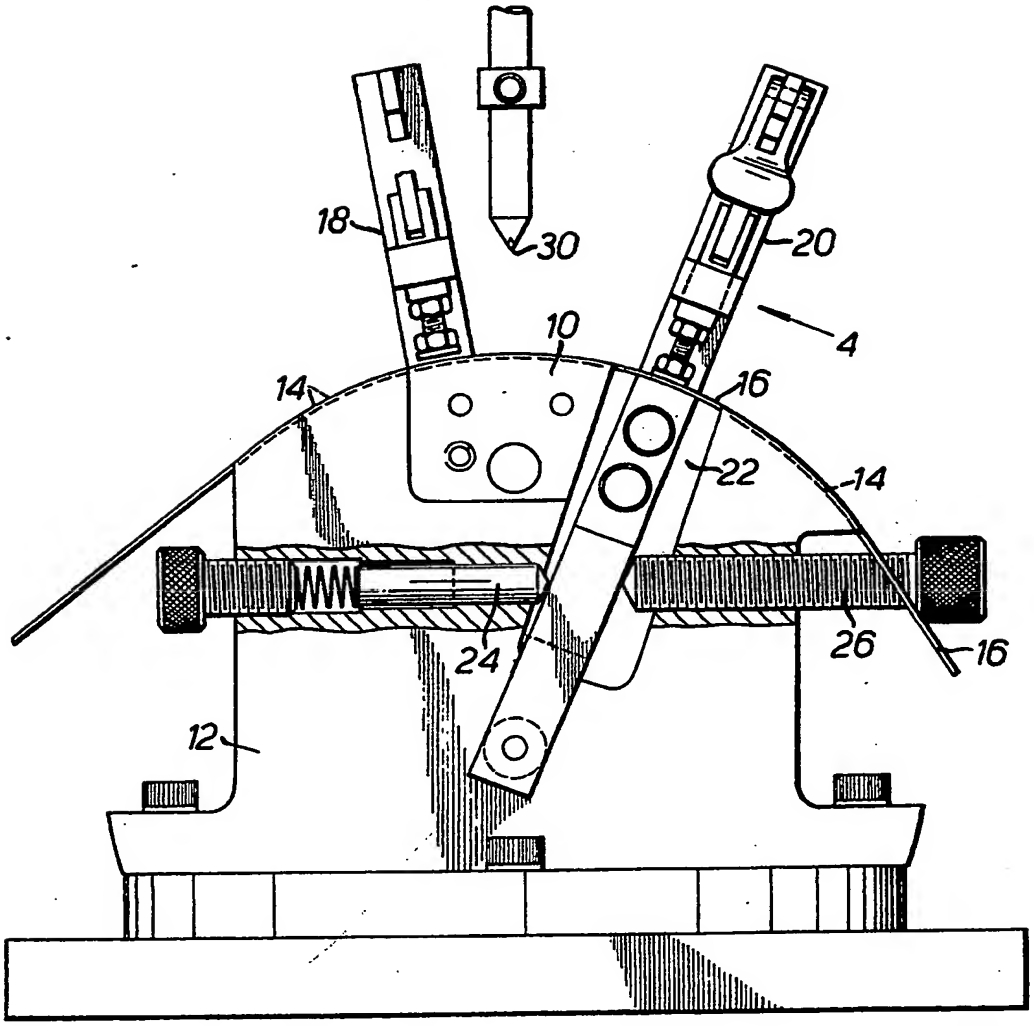

FIG. 3.

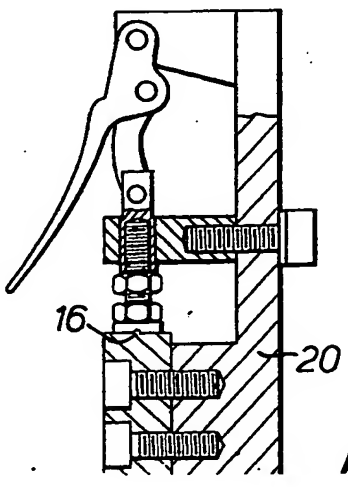

FIG. 4

SPECIFICATION

Improvements in or relating to cutting apparatus

This invention relates to cutting apparatus and more particularly to apparatus for cutting elongate brittle objects such as glass or optical fibres.

It is usually necessary for the ends of optical fibres to be of good quality and with little or no damage to the core or the cladding of the fibre such as lips, misting and hackle. The end face should also preferably be within 1° of the required angle, (usually 90° to the axis of the fibre for a fibre end capable of low loss transmission). These requirements are difficult to achieve repeatedly.

It has been found that when cutting optical fibres optimum results are achieved by the cleavage method which comprises forming a crack in the surface of a fibre and then inducing a single crack to propagate across the fibre from the surface crack by suitably tensioning the fibre. Again this has proved difficult to achieve repeatedly both when using hand-held fibre cutters or when using bench mounted cutters. Typical problems are different and sometimes excessive angles of cut being formed in the fibre end and also cracks being formed around the fibre edges.

It is an object of the present invention therefore to provide cutting apparatus which utilizes the cleavage principle and which is capable or substantially capable of achieving the requirements for low loss transmission from the end of optical fibres repeatedly.

According to the present invention cutting apparatus for cutting elongate brittle objects by the cleavage method comprises stressing means for applying a predetermined value and distribution of stress to the part of the object to be cut and cutting means for cutting into the surface of the object at the part to be cut, the cutting means being adapted to be vibrated across the object in the direction of the required cut.

The stressing means preferably comprises means for applying an axial tension to the part of the object to be cut whilst supporting the part of the object in a predetermined form.

The predetermined form may be an arc and the part of the object is preferably held on an arcuate former.

The means for applying an axial tension to the part may comprise a clamp resiliently urged along the surface of the arcuate former.

The cutting means preferably comprises a diamond scriber which is adapted to be vibrated by a piezo-electric transducer. An embodiment of the inventions will now be described by way of example only with reference to the accompanying drawings in which

Figure 1 is a plan view of apparatus for cutting optical fibres constructed in accordance with the inventor,

Figure 2 is a cross-sectional view of the apparatus taken along the line 2-2 on Figure 1,

Figure 3 is a view of part of the apparatus as seen from arrow 3 on Figure 2 and

Figure 4 is a view of another part of the apparatus as seen from arrow 4 on Figure 3.

The cutter illustrated is intended to be bench mounted and is suitable for cutting silica glass fibres up to around 350μm diameter. More specifically, however it is particularly adapted for fibres of substantially smaller diameter such as 125μm.

The cutter consists basically of an anvil 12 having an arcuate upper surface in which is formed a fine groove 14 for locating an optical fibre 16. The fibre 16 is held in the groove 14 by clamps 18 and 20, the clamp 18 being fixed to the anvil 12 and the clamp 20 being pivoted on the anvil on the centre of the arcuate upper surface of the anvil 12. A portion 22 of the anvil is cut away to permit movement of the clamp 20. A spring urged plunger 24 located in the anvil 12 is adapted to act on the clamp 20 to force it in a clockwise direction when viewed in Figure 3, and a moveable stop in the form of a bolt 26 is located in the anvil on the opposite side of the clamp 20 to adjust the position of the clamp 20 relative to the anvil.

A cantilevered arm 28 holding a wedge shaped diamond cutter 30 at its end is mounted above the anvil 12, the arm being pivoted so that the cutter 30 can be brought into contact with the fibre 16 on the anvil and also removed therefrom.

The arm 28 is counterbalanced by a weight 32 and the rate of downward movement of the arm is restricted by a damped raising and lowering device 34. Movement of a lever 36 raises or lowers the arm 28. By controlling the rate of downward movement of the diamond cutter 30, the possibility of damaging the optical fibre cladding is lessened.

A piezo-electric transducer 38 is incorporated into the arm 28 which, when energised, produces minute vibrations of the cutter 30 axially of the arm 28 imparting a sawing motion to the cutter. This effect reduces the pressure which needs to be applied to the fibre 16 by the cutter 30. It has been found that optimum cutting performance is achieved using a minimum peak-to-peak sinusoidal signal of 3KV at approximately 10KHz. A battery powered tunable oscillator derives the transducer 38 *via* a step up pulse transformer (not shown).

In use the clamp 20 is rotated in an anti-clockwise direction (when viewed in Figure 3) using the bolt 26 until it reaches the left side of the cutaway portion 22. The fibre to be cut is placed over the top of the anvil in the groove 14 and clamped in position with the clamp 18.

The fibre 16 is also clamped in the clamp 20 and this is then released by unscrewing the bolt 26 allowing the spring loaded plunger 24 to force the clamp in a clockwise direction and tension the fibre 16.

The arm 28 is lowered using the lever 36 until it rests on the fibre 16. The piezoelectric transducer is now energised, and when a suitable scratch is formed on the surface of the optical fibre, the fibre

cleaves automatically because of the tension on the fibre applied by the clamp 20.

Whilst the apparatus has been described for use in cutting optical fibres, it will be seen that it will also be suitable for cutting elongate strips of other materials having similar characteristics to those of glass fibres, particularly brittleness.

CLAIMS

1. Cutting apparatus for cutting elongate brittle objects by the cleavage method comprising stressing means for applying a predetermined value and distribution of stress to the part of the object to be cut and cutting means for cutting into the surface of the object at the part to be cut, the cutting means being adapted to be vibrated across the object in the direction of the required cut.

2. Cutting apparatus as claimed in claim 1 in which the stressing means comprises means for applying an axial tension to the part of the object to be cut whilst supporting the part of the object in a predetermined form.

3. Cutting apparatus as claimed in claim 2 in which the predetermined form is an arc.

4. Cutting apparatus as claimed in claim 2 or claim 3 in which the part of the object to be cut is held on an arcuate former.

5. Cutting apparatus as claimed in claim 4 in which the means for applying an axial tension to the part of the object to be cut comprises a clamp resiliently urged along the arcuate former.

6. Cutting apparatus as claimed in any preceding claim in which the cutting means comprises a diamond scriber.

7. Cutting apparatus as claimed in claim 6 in which the diamond scriber is adapted to be vibrated by a piezo-electric transducer.

8. Cutting apparatus as claimed in any preceding claim in which the object to be cut comprises an optical fibre.

9. Cutting apparatus constructed and adapted to operate substantially as hereinbefore described with reference to the accompanying drawings.

Printed for Her Majesty's Stationery Office by The Tweeddale Press Ltd., Berwick-upon-Tweed, 1982.
Published at the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.